

LETTER**Emerging illegal wildlife trade issues: A global horizon scan**

Nafeesa Esmail¹  | Bonnie C. Wintle²  | Michael t Sas-Rolfes¹  | Andrea Athanas³ |
 Colin M. Beale⁴  | Zara Bending^{5,6} | Ran Dai⁷ | Michael Fabinyi⁸ | Sarah Gluszek⁹ |
 Cathy Haenlein¹⁰ | Lauren A. Harrington¹ | Amy Hinsley¹  | Kennedy Kariuki¹¹ |
 Jack Lam¹² | Matthew Markus¹³ | Kumar Paudel¹⁴  | Sofiya Shukhova¹⁵ |
 William J. Sutherland¹⁶ | Diogo Verissimo^{1,17} | Yifu Wang¹⁶ | John Waugh¹⁸ |
 Jon H. Wetton¹⁹ | Catherine Workman²⁰ | Joss Wright¹ | Eleanor J. Milner-Gulland¹

¹University of Oxford, Oxford, United Kingdom of Great Britain and Northern Ireland²University of Melbourne, Melbourne, Australia³African Wildlife Foundation, Gland, Switzerland⁴University of York, York, United Kingdom of Great Britain and Northern Ireland⁵The Jane Goodall Institute Global, Vienna, Austria⁶Macquarie University, Sydney, Australia⁷King Mongkut's University of Technology Thonburi, Bangkok, Thailand⁸University of Technology Sydney, Broadway, Australia⁹Fauna & Flora International, Cambridge, United Kingdom of Great Britain and Northern Ireland¹⁰Royal United Services Institute for Defence and Security Studies, London, London, United Kingdom of Great Britain and Northern Ireland¹¹Meru Carnivore Project, Meru, Kenya¹²City University of Hong Kong, Hong Kong, China¹³Pembient, Inc., Seattle, Washington¹⁴Greenhood Nepal, Kathmandu, Nepal¹⁵Animal Concerns Research and Education Society, Singapore, Singapore¹⁶University of Cambridge, Cambridge, United Kingdom of Great Britain and Northern Ireland¹⁷Institute for Conservation Research, San Diego Zoo Global, San Diego, United States¹⁸Integra Government Services International, Washington, United States¹⁹Department of Genetics and Genome Biology, University of Leicester, Leicester, United Kingdom of Great Britain and Northern Ireland²⁰National Geographic Society, Washington, United States**Correspondence**

Nafeesa Esmail, University of Oxford, Department of Zoology, South Parks Road, OX1 3PS, Oxford, UK.

Email: nafeesa.esmail@gmail.com

Funding information

Oxford Martin School, University of Oxford, Grant/Award Number: R56377/RE001

Abstract

Illegal wildlife trade is gaining prominence as a threat to biodiversity, but addressing it remains challenging. To help inform proactive policy responses in the face of uncertainty, in 2018 we conducted a horizon scan of significant emerging issues. We built upon existing iterative horizon scanning methods, using an open and global participatory approach to evaluate and rank issues from a diverse range of sources.

This is an open access article under the terms of the Creative Commons Attribution License, which permits use, distribution and reproduction in any medium, provided the original work is properly cited.

© 2020 The Authors. Conservation Letters published by Wiley Periodicals, Inc.

Prioritized issues related to three themes: developments in biological, information, and financial technologies; changing trends in demand and information; and socioeconomic, geopolitical shifts and influences. The issues covered areas ranging from changing demographic and economic factors to innovations in technology and communications that affect illegal wildlife trade markets globally; the top three issues related to China, illustrating its vital role in tackling emerging threats. This analysis can support national governments, international bodies, researchers, and nongovernmental organizations as they develop strategies for addressing the illegal wildlife trade.

KEYWORDS

Africa, conservation, East Asia, expanding trade networks, global policy trends, Latin America, misinformation, online platforms, strategic foresight, wildlife trafficking

1 | INTRODUCTION

Thousands of species are subject to illegal wildlife trade (IWT), defined here as the unlawful buying or selling of harvested wild species (or derivatives; 't Sas-Rolfes, Challengier, Hinsley, Veríssimo, & Milner-Gulland 2019). Due to its complexity and typically covert nature, the absolute scale and value of IWT is challenging to assess, but estimates place it in the top five illegal transnational trades, alongside arms and drugs (UNODC, 2016; van Uhm, 2016). Impacts extend beyond biodiversity, as criminal involvement may destabilize governments and economies (Felbab-Brown, 2017) and damage livelihoods and security for those living with wildlife (Riskas, Tobin, Fuentes, & Hamann, 2018). However, IWT also provides income to individuals with limited alternatives (Harrison, Baker, Twinamatsiko, & Milner-Gulland, 2015) and valued goods, such as bushmeat, to consumers (Boratto & Gore, 2018).

While predicting and responding to IWT is challenging, there are growing opportunities to influence global and national policies. For example, in 2015, the UN General Assembly adopted its first wildlife trafficking resolutions (UNGA, 2015). In 2014–2018, the UK government led a series of four international conferences and one regional event, specifically aimed at addressing the topic. At the Convention on Biological Diversity's 13th Conference of the Parties, a decision was made to provide technical guidance towards a more sustainable bushmeat sector. The direct exploitation of organisms, including illegal extraction to meet local and global markets, was ranked second of five key drivers of harmful ecosystem change in the Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services' first global assessment (IPBES 2019).

Global IWT policy-making involves a range of stakeholders, operating within and between systems of varying compatibility. Currently, member state compliance with interna-

tional agreements, such as CITES (the Convention on International Trade in Endangered Species of Wild Fauna and Flora), provides the dominant means for governing wildlife trade to ensure it does not threaten species ('t Sas-Rolfes et al., 2019). Increasing attention has recently focused on transnational organized crime and related security dimensions, broadening the scope of IWT policy, and action to involve bodies such as the UN Security Council, Interpol, and the United Nations Office on Drugs and Crime (UNODC). Regional and global policy initiatives focus on enforcement, technical assistance, and capacity building, yet effective counter-IWT measures hinge on the political will of nation states. Such a multifaceted policy-making environment requires proactive approaches informed by interdisciplinary input, leveraging relevant innovations in technology, governance, and information systems.

IWT is often unpredictable, involving fluid markets and clandestine crime. In this complex landscape, appropriate policy responses should be informed by empirical evidence. While some trends in the *legal* wildlife trade are relatively well-documented (Harfoot et al., 2018), little has been done to analyze IWT trends and patterns systematically. Proxy measures of IWT, such as seizure data (Rosen & Smith, 2010), provide some indication of trade routes and scale, but contain detection and reporting biases (Underwood, Burn, & Milliken, 2013). Seizures tend to be biased towards charismatic megafauna (e.g., elephant ivory) and may constitute less than 10% of all illegal trade (van Uhm, 2016). Information linked to underlying drivers and trends shaping IWT is even more difficult to obtain. In the face of such uncertainty, poorly informed public responses may drive politically popular, but ultimately counterproductive, policy measures.

This first global horizon scan of IWT aims to inform proactive policy responses by governments, international conventions and NGOs to prioritize key IWT issues, underpinned by emerging empirical evidence. Horizon scanning is particularly useful for gathering, organizing and prioritizing new and

existing evidence about emerging issues in a timely, structured, and transparent way (Wintle, Kennicutt & Sutherland, 2020). It can be used for policy and decision-making alongside other strategic foresight tools, such as scenario planning (Cook, Inayatullah, Burgman, Sutherland, & Wintle, 2014).

Horizon scanning systematically searches diverse information streams (Amanatidou et al., 2012) and identifies emerging threats and opportunities (Sutherland & Woodroof, 2009). By helping understand system dynamics and anticipate the future, horizon scanning can support better coordination of resources, responsive policy or on-the-ground action to address issues before full impacts are realized (Konnola, Salo, Cagnin, Carabias, & Vilkkumaa, 2012). The policy impact of horizon scanning exercises is challenging to gauge, because decisions typically reflect a blend of inputs (Wintle, Kennicutt & Sutherland, 2020). Nonetheless, other horizon scans have set a precedent of informing policy and decisions. For example, priorities identified in an Antarctic Science Horizon Scan (Kennicutt et al., 2014) were used to invoke financial support for joint science programs on ice sheet research (National Science Foundation, 2016), and issues identified in annual global conservation scans (e.g., Sutherland et al., 2018) have informed the U.K.'s Natural Environment Research Council's "Forward Look" strategic planning.

Scans for global conservation issues have been conducted for 10 years (e.g., Sutherland et al., 2018), and topics thus identified have had widespread salience. Illustrating this, in 2009, only 23% of respondents had heard of microplastic pollution, 46% of synthetic meat, and 69% of mobile sensing technology; today, these are mainstream issues (Sutherland et al., 2019). Our horizon scan provides insights into how complex economic, sociopolitical, financial, and ecological systems relate to IWT. Building on existing structured methods, but using an open and inclusive approach participation, it highlights a diverse range of emerging topics to consider when formulating policy and coordinating resources.

2 | METHODS

We adapted the Delphi-like method used in other horizon scans (Mukherjee et al., 2015; Sutherland et al., 2018). Through anonymity, iteration, facilitated discussion, structured elicitation, and aggregation of individual judgments, the method is designed to democratically incorporate a range of perspectives and mitigate psychological biases that typically befall individuals and groups (Burgman, 2016).

Many scans solicit direct input from an invited expert group and require participants to meet in person. There is always a risk that particular topics may be more likely to be suggested when they closely align with the person's own research interests, and that more senior people, seen as "experts," may have particular worldviews and experiences that limit their

perspectives. To help mitigate this potential source of bias, we cast a wide net to solicit the first round of ideas from as many different contributors as possible, to capture diverse interests from around the world. To do so, we used an open online platform, which accommodated 29 languages and remotely engaged contributors who might not otherwise be able to participate (Hemming, Burgman, Hanea, McBride, & Wintle, 2017; McBride et al., 2012). An online call for participation was disseminated via targeted individuals and approximately 45 networks, groups, and organizations, encompassing a range of relevant disciplines and institution types. The call reached a minimum of 5,000 people. Supplementary Material 1 provides specific methodological details.

The study followed a stepwise procedure, with all stages remotely facilitated, to identify and prioritize emerging issues with the potential to have substantial positive and/or negative impacts on IWT over the next 5–10 years (Figure 1). Ultimately, the usefulness of horizon scanning can only be judged retrospectively based on whether the issues have come to pass within the specified time frame and how the scan has informed proactive responses (Sutherland et al., 2019).

Up to five issues were elicited from each contributor (*Stage 1*), who were asked to think widely, consult their networks, and conduct their own research. Thirty-nine nationalities and wide expertise (including biomedical engineering, conservation, criminology, earth sciences, ecology, economics, geography, law, political science, and sociology) were represented in the initial contributor group (139 individuals). Eighty-seven percent of contributors were affiliated with institutions. Of those, 65% were affiliated with academia, 50% NGOs, 17% consultancy, 13% government, 10% multilateral organizations, and 7% private sector. Contributors worked in multiple regions: 55% Africa, 50% Asia-Pacific, 26% Europe, 17% North America, and 11% Latin America.

The initial list was thematically organized and anonymized by the facilitators (Esmail & Wintle). Unsuitable material (which conveyed a perceived need, knowledge gap, opinion, or promotion) was removed. A consolidated list was circulated to "assessors", a subset of contributors who had submitted well-researched contributions accompanied by links to evidence (i.e., papers, reports, etc.), chosen to balance background, expertise, and geographical diversity (the remaining authors). Six of 139 people submitted issues in a language other than English; among the 25 authors there was fluency in at least 10 languages, allowing evidence from a range of sources to be assessed.

In *Stage 2*, the assessors independently and anonymously scored (on a scale of 0–1000) each issue based on novelty, plausibility, and potential future impact on IWT. Raw scores were converted to *z*-scores, ranked (Wintle et al., 2017), and the top 45 were shortlisted. Assessors reported whether they had previously heard of each issue; the least known reflecting some of the most novel issues. Before *Stage 3*, the

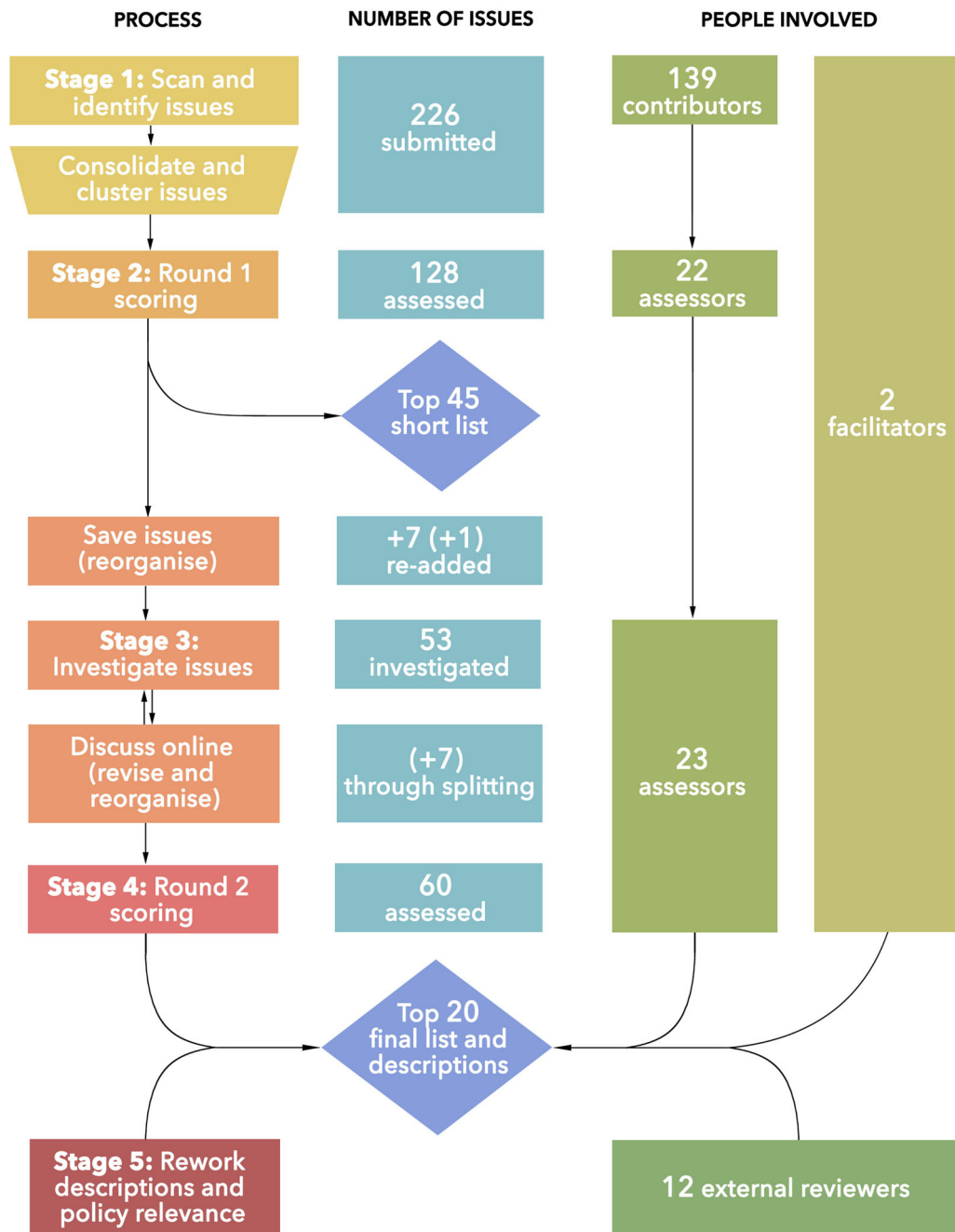


FIGURE 1 Methodological stages illustrating the number of people involved and treatment of issues at each stage. Assessors and facilitators are the paper's authors

opportunity was given to “save” any of the originally assessed 128 issues not shortlisted through scoring, if substantiated with well-justified reasoning. Eight additional issues were saved, meaning 53 issues moved to *Stage 3*. Here, each assessor was randomly assigned 4–5 issues to investigate, ensuring that each issue was closely examined by 2–3 people and equally considered before discussion. This helped mitigate potential biases from people focusing solely on their own “pet” topics, or eye-catching topics. In *Stage 4*, authors discussed insights into each issue from their investigations

and experiences via an online forum. This culminated with a second scoring round to produce a final ranked list of 20. Again, scoring was independently completed by each assessor with scores aggregated, so decisions on the final list were not dominated by the loudest voice. The facilitators then reworked final issue descriptions and grouped them into overarching themes. We cross-validated these groupings and links between themes by conducting topic modeling, based on the descriptive text, using Latent Dirichlet Allocation (Blei, Ng, & Jordan, 2003; Supplementary Material 4). To clarify

the policy relevance of issues and refine their descriptions, we drew upon issue-specific expertise from an additional 12 external reviewers (*Stage 5*).

3 | RESULTS

The top 20 issues fell under three overarching themes: (i) *Geographic (political, demographic, and socioeconomic) shifts and influences*; (ii) *Scientific and technological innovation*, and (iii) *Changing trends in demand and information* (Figure 2). Topics identified through the Latent Dirichlet Allocation analysis largely complemented our qualitative analysis of overarching themes; results are presented in Supplementary Material 4. In Supplementary Material 2, we provide details of the top 20 issues, with brief descriptions of the following 40. Policy directions are mapped out for all top issues in Supplementary Material 3, intended as a platform for further discussion and decision-making.

Issues under the first theme, *Geographic shifts and influences* include changing geopolitical processes and the rising global influence of East Asia. Authors noted political, demographic, and economical changes, which could facilitate greater access to wildlife, and stimulate growing demand (but also sustainable opportunities) for IWT products. These issues were the top three ranked: *Issue 1*—the political support and cultural revival of Traditional Chinese Medicine (TCM; Zheng, 2016; Table 1); *Issue 2*—the increasing role of China in developing countries, through international aid, investment, and diaspora; and *Issue 3*—the rapid expansion of new international trade routes, particularly in the context of the Belt and Road Initiative (Chinese State Information Centre, 2019).

In key wildlife source countries, especially in Africa and Latin America, recent developments create conditions that may exacerbate IWT. This includes freer trade and migration policies, with aspirations for rapid economic growth and prosperity across Africa (African Union, 2018; *Issue 7*). Rapid human population growth, alongside continued agricultural land conversion and natural habitat encroachment, also affects sub-Saharan Africa (*Issue 8*), leading to increased human–wildlife conflict, resource pressure, and wildlife crime (Kideghesho, 2016). Indicated by expanding Asian-influenced demand for its range of commodities and species, Latin America was also considered increasingly prominent in IWT activities, with trade often passing undetected through established smuggling routes (*Issue 20*). Political and socioeconomic instability in the region was highlighted, with the current crisis in Venezuela identified as a significant potential catalyst for IWT, facilitating both extraction and transit (Sánchez-Mercado et al., 2020) and impacting neighboring countries (*Issue 9*).

Issues under the second theme, *Scientific and technological innovation*, fell into two broad categories: (1)

biotechnology and 2) information technology (IT), including financial technology. The most highly ranked under this theme was *Issue 4*: genetic technological advancements (e.g., Parker, Helmstetter, & Papadopulos, 2018), enabling rapid, cost-effective assessments, and traceability of product identity and source at the species and individual levels. Such advances can provide critical evidence to penalize and deter wildlife traffickers. Increased availability of portable devices also offers the potential to increase legal trade monitoring.

Three recent IT developments were deemed significant. *Issue 17* concerns the shift of IWT operations and transactions onto and between digital platforms, such as closed social media groups (Xiao, Guan, & Xu, 2017), with trade aided by the convergence of online and mobile payment systems and cryptocurrencies (*Issue 12*). Both reflect the increasing exploitation of digital platforms for advertising and IWT-related transactions, by sellers and buyers. Closely related is *Issue 13*: the role of social media as a marketplace and forum that can either stimulate or deter IWT (e.g., Nekaris, Campbell, Coggins, Rode, & Nijman, 2013). Relatedly, *Issue 16* highlights the emerging use of financial analysis and investigation tools to help track and disrupt IWT-related transactions (Haenlein & Keatinge, 2017), enabling law enforcement to incorporate this into their broader IWT responses.

Our third theme, *Changing trends in demand and information*, encompasses a range of issues around specific products and markets. Markets for certain taxa and wildlife-derived products are growing, with threats underappreciated. These include demand for *Haiwei*, dried seafood (*Issue 10*), medicinal plants (*Issue 19*), and cave beetles in Eastern Europe's karst landscapes (*Issue 18*), which are at risk of extinction before being scientifically described. *Issue 14* highlights the general concern that newly discovered species (desired by collectors for their novelty) may quickly become targets due to easier-to-access locational information (Lindenmayer & Scheele, 2017).

Linked to themes two and three, public–private collaborations help identify and disrupt illicit financial flows by using financial institutions' antimoney laundering technology and infrastructure, and information exchange to facilitate investigations and prosecutions (*Issue 15*; APG & UNODC, 2017). Another cross-thematic issue is that, in the modern age of networked communication, misinformation (from market participants, intergovernmental bodies, NGOs, policymakers and/or the media) can rapidly influence policy and practice (*Issue 5*). This can be difficult to correct and can undermine conservation efforts by skewing policy responses and potentially misdirecting scarce resources.

Finally, and linking back to our first theme, two additional cross-thematic issues were identified. *Issue 6* highlights how urbanization (across Africa and Asia) may change the dynamics of wild meat markets (Boratto & Gore, 2018). As supplies diminish and restrictions on harvesting certain species

TABLE 1 Policy perspective of the top ranked horizon scan issue

1: Cultural revival and political support of Traditional Chinese Medicine (TCM) supporting demand for certain wildlife products			
Current policy context	Relevant actors and institutions: stakeholders to consider	Knowledge gaps	Potential policy and management approaches: ideas for discussion
<p>Section 4.2 of Traditional Chinese Medicine Could Make 'Health for One' True, states: "In order to ensure sustainable supplies of natural produce, planting, and farming endangered species of wildlife are encouraged by the government, community, and the international organization."^a</p> <p>Strategic objective 1 of WHO Traditional Medicine Strategy, states: "Member States should strengthen their own knowledge generation, collaboration, and sustainable use of TCM resources. It is important that Member States and stakeholders are mindful of biodiversity and international treaties concerning endangered species."^b</p> <p>China's National Regulation on Protection of Wild Medicinal Resources (1987), Law of the People's Republic of China on TCM (2017), Pharmaceutical Administration Law of the People's Republic of China (2015 Amendment).</p> <p>Existing CITES measures to regulate trade of wildlife products derived from listed species.</p> <p>SDG 3: Good Health and Well-being (However there is no mention of traditional medicines).</p>	<p>TCM associations (e.g., China's National Administration of TCM), regional hospitals and local medicinal marketplaces.</p> <p>Pharmaceutical industries and TCM education sectors.</p> <p>National and regional pharmaceutical market and labeling regulators (e.g., State Administration for Market Regulation).</p> <p>National importation regulators, CITES management authorities, and customs agencies.</p> <p>International development agencies, multilaterals, and intergovernmental bodies (e.g., WB, WTO, WHO, FAO, UNDP, UNEP).</p> <p>General public, particularly users/consumers.</p>	<p>What pharmacopoeia is being promoted?</p> <p>Where do the wildlife-related ingredients for the medicines in the pharmacopoeia originate?</p> <p>How are these ingredients currently sourced?</p> <p>Are these ingredients sustainable now? In the future, given predicted demand?</p> <p>What acceptable substitutes exist for unsustainable ingredients?</p> <p>Will TCM practitioners adhere to the pharmacopoeia? If not, what other species may be affected?</p>	<p>Implement evidence-based regulation of unsustainably sourced products (alongside monitoring of medicines over a certain quantity).</p> <p>Raise awareness of all stakeholders of issues of biodiversity and conservation. Conduct targeted consumer / practitioner behavior change interventions.</p> <p>Create an open-access online platform to integrate policy transparency and accountability.^c</p> <p>Integrate issue into intergovernmental regulatory platforms and institutions (e.g., FAO food safety regulations; WHO pharmaceutical safety regulations).</p> <p>Strengthen control and screening at customs ports. Particularly because TCM may expand rapidly outside of China due to the Belt & Road Initiative and other similar plans</p>

This table is not exhaustive, (e.g., it largely omits local and national processes and stakeholders) but represents a starting point to inform policy and management and guide strategic responses. (See Supplementary Material 3 for Acronym List and perspectives for other issues.)

^aWorld Health Organisation Commission on Intellectual Property Rights, Innovation and Public Health. Traditional Chinese Medicine Could Make 'Health for One' True, 2007. Retrieved from <https://www.who.int/intellectualproperty/studies/Jia.pdf>

^bWorld Health Organisation. WHO Traditional Medicine Strategy: 2014–2023, 2013. Retrieved from <https://apps.who.int/iris/handle/10665/92455>

^cSee the Institute for Policy Integrity Government Transparency and Accountability project, as an example: <https://policyintegrity.org/projects/transparency-and-accountability>

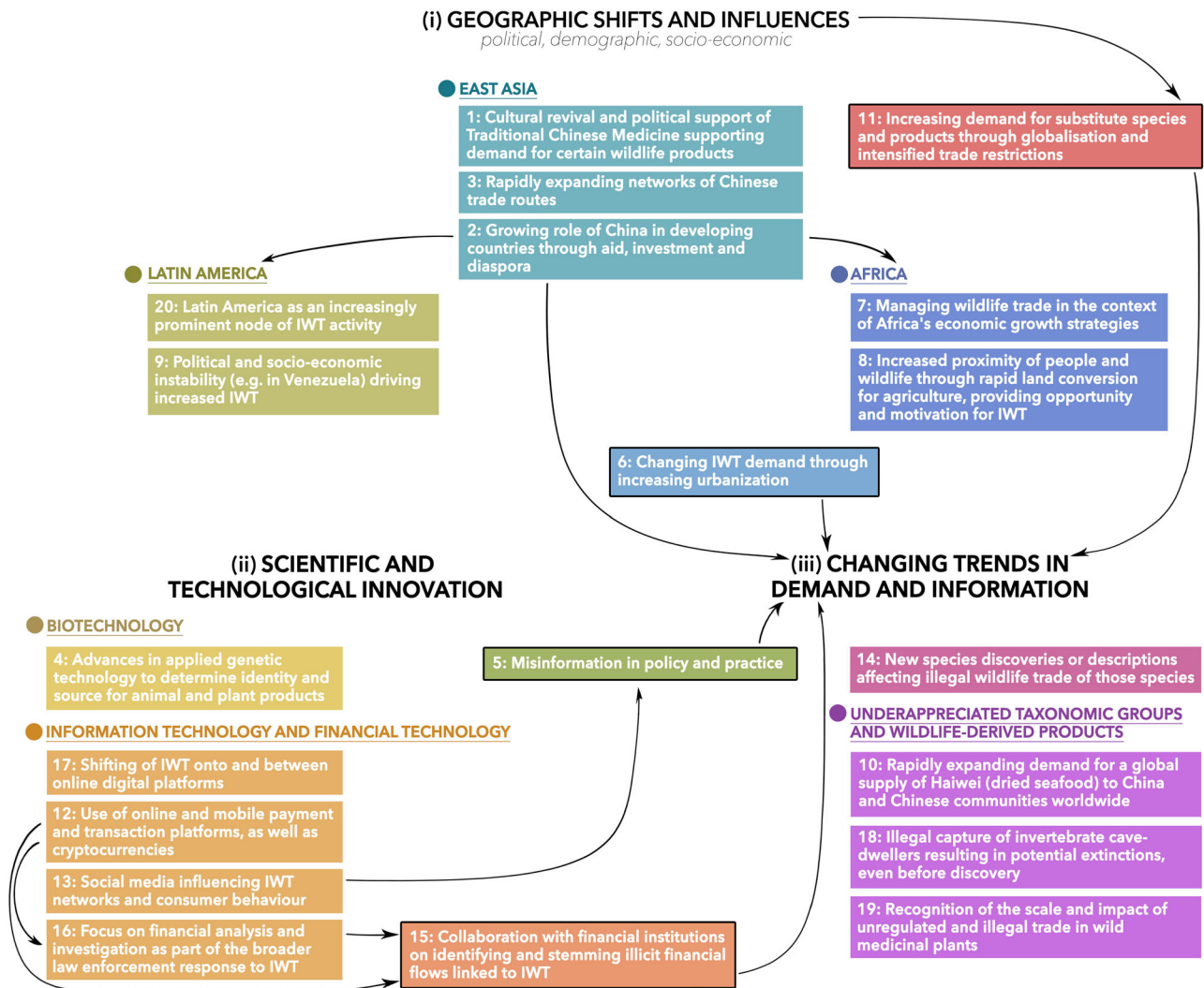


FIGURE 2 The top 20 issues with linkages drawn between them. Numbering represents the rank order of the issues. Those outlined in black are cross-thematic issues. (See Supplementary Material 2 for descriptions of all issues.)

intensify, substitutes for wildlife products (such as tiger parts, timber, orchids) are increasingly sought with globalization facilitating this shift towards analogue species (*Issue 11*).

4 | DISCUSSION

Through an inclusive and democratic horizon scanning strategy, we prioritized 20 issues from which three interlinked themes emerged. Many are double-edged; for instance, a more networked world allows both illegal traders and conservationists to form new alliances and influence public opinion and behavior. Rapidly emerging technologies are changing the speed and ways people react to newly opened markets and information sources. In particular, the growing reach of mobile technology and physical access into new areas (including remote, rural, and marine locations) presents opportunities for both IWT perpetrators and conservationists.

This dynamic IWT environment presents a challenge as mitigation efforts are inherently reactive to trafficking activities and thwarted by jurisdictional boundaries.

Many issues relate to changing social, economic, political, and governance regimes, with the potential to both enable and limit IWT. Major initiatives, such as China's Belt and Road Initiative and African economic growth strategies, may bring prosperity, but also biodiversity loss. A number of issues (relating to agricultural conversion, urbanization, TCM promotion, East Asia's influencing role, African growth strategies, skewed African demographics towards younger people, and a rising Asian middle class) circle back to underlying topics of human population growth and overconsumption; major and contentious causes of current and future conservation challenges.

Given a key aim of addressing IWT is to conserve biodiversity (IPBES, 2019), a broader perspective is needed, requiring integrated responses across sectors. Policy and funding

currently tend to focus on large, charismatic species, predominantly traded from Africa to Asia, with wider ecological values sometimes overlooked. Additionally, it can be difficult to predict which species and areas will become the next targets, especially if they are lesser known. Of the taxonomically focused issues captured, we prioritized those we believed to be most neglected in IWT discourse (i.e., cave invertebrates, medicinal plants, *Haiwei*, seabirds), while acknowledging prioritizing one taxon over another is a value judgment. We also recognize that the issues identified were informed by the expertise of scan participants, who were predominantly sourced through the Oxford Martin Programme on the Illegal Wildlife Trade mailing list. A different group of people might have identified and prioritized different specific issues. Similarly, limiting participants to those with more horizon scanning experience might have yielded a different balance between issues that are truly novel and those that are already well-evidenced. However, this would have reduced contributor diversity, thereby potentially also limiting the range of issues considered. This does not negate the issues selected, but highlights the need for regular scans and wide consultation. Future scans should incorporate all relevant voices even more actively, ensuring local community perspectives are heard as well as those sourced through international-level processes.

IWT dialogues are often perceived as “western-led”. But as local and national voices seek more authority over natural patrimony, sovereignty, and self-determination, this is changing. Notably, our scan identifies greater commitment to tackling IWT from African political leaders, particularly through peer-to-peer dialogues (*Issue 34*) and initiatives that support recognition of and engagement with local communities (*Issue 38*). Furthermore, the pivotal role of China in tackling IWT is highlighted. However, expanding demand for wildlife products due to rising prosperity is not unique to China and its neighbors. Future agendas for tackling IWT would benefit from coordinated efforts linking major centers of supply, demand, and trade across the world.

Many issues cut across several policy arenas and stakeholders. Conducting in-depth stakeholder and policy-gap analyses for each issue can highlight those in need of cross-sectoral input and help inform appropriate action, by identifying other relevant individuals, groups, policies or legislation, considering their relationships, and prioritizing their involvement in the decision-making process (see Supplementary Material 3 as a starting point). It would also be useful to further “roadmap” the path to a *particular* policy impact by carrying out feasibility assessments of different options, informed by filling necessary knowledge gaps. Techniques to support evidence-based decision-making in uncertain conditions (e.g., scenario planning) can also assist in assessing the most relevant possible futures and policies.

Our findings underpin policy briefing documents, presented at the 2018 London IWT Conference and the 18th

CITES Conference of the Parties in August 2019 (Esmail et al., 2019). This scan might be similarly useful to large-scale funders (such as governments and international NGOs) as a guide for prioritizing strategic funding programs, and for highlighting issues to raise during intergovernmental discussions on strategic approaches to tackling IWT. We recommend regular systematic IWT horizon scanning, both nationally and globally, as a proactive management tool to detect issues before they become urgent, ubiquitous, and thus unmanageable. This could be integrated into strategic planning by donors, regulatory bodies, and international partnerships addressing transnational crime, to better coordinate resources and interventions, preemptively addressing challenges while solutions are achievable. We hope that future-orientated exercises such as this may help conservation shift its focus from responding to crises to preparing for what is to come.

ACKNOWLEDGEMENTS AND DATA

We thank all those involved in this project (see Supplementary Material 5 for complete contributor lists). Special thanks to the numerous external reviewers who contributed at various stages, including peer-review. We gratefully acknowledge the financial support of the Oxford Martin Programme on the Illegal Wildlife Trade. WJS is funded by Arcadia. Research ethical approval was received from the University of Oxford (CUREC 1A Approval Ref: R56377/RE001).

ORCID

Nafeesa Esmail  <https://orcid.org/0000-0001-6043-2014>
 Bonnie C. Wintle  <https://orcid.org/0000-0003-0236-6906>
 Michael t Sas-Rolfes  <https://orcid.org/0000-0002-2220-6072>
 Colin M. Beale  <https://orcid.org/0000-0002-2960-5666>
 Amy Hinsley  <https://orcid.org/0000-0002-5590-7617>
 Kumar Paudel  <https://orcid.org/0000-0002-2041-3596>

REFERENCES

- African Union. (2018). Assembly of the Union: Tenth extraordinary session. Retrieved from https://au.int/sites/default/files/decisions/34055-ext_assembly_dec_1x_e26_march.pdf
- Amanatidou, E., Butter, M., Carabias, V., Konnola, T., Leis, M., Saritas, O., ... Rij, V. V. (2012). On concepts and methods in horizon scanning: Lessons from initiating policy dialogues on emerging issues. *Science and Public Policy*, 39(2), 208–221. <https://doi.org/10.1093/scipol/scs017>.
- Asia Pacific Group on Money Laundering (APG) & United Nations Office on Drugs and Crime (UNODC). (2017). *Enhancing the detection, investigation and disruption of illicit financial flows from wildlife crime*. Retrieved from https://www.unodc.org/documents/southeastasiaandpacific/Publications/2017/FINAL_-_UNODC_APG_Wildlife_Crime_report.pdf

- Blei, D. M., Ng, A. Y., & Jordan, M. I. (2003). Latent Dirichlet Allocation. *Journal of Machine Learning Research*, 3(4–5), 993–1022. <https://doi.org/10.1162/jmlr.2003.3.4-5.993>.
- Boratto, R., & Gore, M. L. (2018). *The bushmeat supply chain in Pointe Noire, Republic of the Congo: A conservation criminology analysis June 2016–January 2017*. <https://doi.org/10.13140/RG.2.2.18391.37284>.
- Burgman, M. A. (2016). *Trusting judgements: How to get the best out of experts*. Cambridge, UK: Cambridge University Press.
- Chinese State Information Centre. (2019). Belt & Road Portal. Retrieved from <https://www.yidaiyilu.gov.cn>
- Cook, C. N., Inayatullah, S., Burgman, M. A., Sutherland, W. J., & Wintle, B. A. (2014). Strategic foresight: How planning for the unpredictable can improve environmental decision-making. *Trends in Ecology & Evolution*, 29, 531–541.
- Esmail, N., Harrington, L., Lam, J., Malsch, K., Milner-Gulland, E. J., Bending, Z., & 't Sas-Rolfes, M. (2019). Horizon scanning for illegal wildlife trade: A strategic approach to inform future CITES Policy Decisions. Retrieved from <https://www.oxfordmartin.ox.ac.uk/publications/cites-briefing-2019/>
- Felbab-Brown, V. F. (2017). *The extinction market wildlife trafficking and how to counter it*. London: C. Hurst & Company.
- Haenlein, C., & Keatinge, T. (2017). *Follow the money: Using financial investigation to combat wildlife crime* (Occasional Paper). Royal United Service Institute for Defence and Security Studies. Retrieved from https://rusi.org/sites/default/files/201709_rusi_follow_the_money_haenlein.keatinge.pdf
- Harfoot, M., Glaser, S. A. M., Tittensor, D. P., Britten, G. L., McLardy, C., Malsch, K., & Burgess, N. D. (2018). Unveiling the patterns and trends in 40 years of global trade in CITES-listed wildlife. *Biological Conservation*, 223, 47–57. <https://doi.org/10.1016/j.biocon.2018.04.017>.
- Harrison, M., Baker, J., Twinamatsiko, M., & Milner-Gulland, E. J. (2015). Profiling unauthorized natural resource users for better targeting of conservation interventions. *Conservation Biology*, 29, 1636–1646. <https://doi.org/10.1111/cobi.12575>.
- Hemming, V., Burgman, M. A., Hanea, A. M., McBride, M. F., & Wintle, B. C. (2017). A practical guide to structured expert elicitation using the IDEA protocol. *Methods in Ecology and Evolution*, 9(1), 169–180. <https://doi.org/10.1111/2041-210x.12857>.
- IPBES. (2019). Intergovernmental Platform on Biodiversity and Ecosystem Services—Summary for policymakers of the global assessment report. Retrieved from https://www.ipbes.net/sites/default/files/downloads/spm_unedited_advance_for_posting_htn.pdf
- Kennicutt, M., Chown, S., Cassano, J., Liggett, D., Massom, R., Peck, L., ... Sutherland, W. J. (2014). Polar research: Six priorities for Antarctic science. *Nature*, 512, 23–25. <https://doi.org/10.1038/512023a>.
- Kideghesho, J. (2016). Reversing the trend of wildlife crime in Tanzania: Challenges and opportunities. *Biodiversity and Conservation*, 25, 427–449. <https://doi.org/10.1007/s10531-016-1069-y>.
- Konnola, T., Salo, A., Cagnin, C., Carabias, V., & Vilkkumaa, E. (2012). Facing the future: Scanning, synthesizing and sense-making in horizon scanning. *Science and Public Policy*, 39, 222–231. <https://doi.org/10.1093/scipol/scs021>.
- Lindenmayer, L., & Scheele, B. (2017). Do not publish. *Science*, 356, 800–801. <https://doi.org/10.1126/science.aan1362>.
- McBride, M., Garnett, S. T., Szabo, J. K., Burbidge, A. H., Butchart, S. H. M., Christidis, L., & Burgman, M. A. (2012). Structured elicitation of expert judgments for threatened species assessment: A case study on a continental scale using email. *Methods in Ecology and Evolution*, 3, 906–920.
- Mukherjee, N., Hugé, J., Sutherland, W. J., McNeill, J., Opstal, M. V., Dahdouh-Guebas, F., & Koedam, N. (2015). The Delphi technique in ecology and biological conservation: Applications and guidelines. *Methods in Ecology and Evolution*, 6, 1097–1109. <https://doi.org/10.1111/2041-210x.12387>.
- National Science Foundation. (2016, October 20) Thwaites: The future of Thwaites glacier and its contribution to sea-level rise. Polar Programs. Retrieved from https://www.nsf.gov/funding/pgm_summ.jsp?pims_id=505320&org=OPP&from=home
- Nekaris, K. A., Campbell, N., Coggins, T. G., Rode, E. J., & Nijman, V. (2013). Ticked to death: Analysing public perceptions of “Cute” videos of threatened species (slow Lorises —*Nycticebus* spp.) on Web 2.0 Sites. *PLoS One*, 8(7), e69215 <https://doi.org/10.1371/journal.pone.0069215>.
- Parker, J., Helmstetter, A. J., & Papadopoulos, A. S. (2018). Rapid, raw-read reference and identification (R4IDs): A flexible platform for rapid generic species ID using long-read sequencing technology. <https://doi.org/10.1101/281048>
- Riskas, K. A., Tobin, R. C., Fuentes, M. M., & Hamann, M. (2018). Evaluating the threat of IUU fishing to sea turtles in the Indian Ocean and Southeast Asia using expert elicitation. *Biological Conservation*, 217, 232–239. <https://doi.org/10.1016/j.biocon.2017.10.011>.
- Rosen, G., & Smith, K. (2010). Summarizing the evidence on the international trade in illegal wildlife. *Ecohealth*, 7, 24–32. <https://doi.org/10.1007/s10393-010-0317-y>.
- Sánchez-Mercado, A., Asmussen, M., Rodríguez, J. P., Moran, L., Cardozo-Urdaneta, A., & Morales, L. I. (2020). Illegal trade of the Psittacidae in Venezuela. *Oryx*, 54(1), 77–83. <https://doi.org/10.1017/S003060531700120X>.
- Sutherland, W. J., & Woodroof, H. (2009). The need for environmental horizon scanning. *Trends in Ecology & Evolution*, 24, 523–527. <https://doi.org/10.1016/j.tree.2009.04.008>.
- Sutherland, W. J., Broad, S., Butchart, S. H., Clarke, S. J., Collins, A. M., Dicks, L. V., & Ockendon, N. (2018). A horizon scan of emerging issues for global conservation in 2019. *Trends in Ecology & Evolution*, 34, 83–94. <https://doi.org/10.1016/j.tree.2018.11.001>.
- Sutherland, W. J., Fleishman, E., Clout, M., Gibbons, D. W., Lickorish, F., Peck, L. S., & Ockendon, N. (2019). Ten years on: A review of the first global conservation horizon scan. *Trends in Ecology & Evolution*, 34, 139–153. <https://doi.org/10.1016/j.tree.2018.12.003>.
- 't Sas-Rolfes, M., Challenger, D. W., Hinsley, A., Veríssimo, D., & Milner-Gulland, E. J. (2019). Illegal Wildlife Trade: Scale, Processes and Governance. *Annual Review of Environment and Resources*, 44, 1. <https://doi.org/10.1146/annurev-environ-101718-033253>
- Underwood, F. M., Burn, R. W., & Milliken, T. (2013). Dissecting the illegal ivory trade: An analysis of ivory seizures data. *PLoS One*, 8(10). <https://doi.org/10.1371/journal.pone.0076539>.
- United Nations General Assembly (UNGA). (2015). Tackling illicit trafficking in wildlife. Retrieved from <https://undocs.org/en/A/RES/69/314>
- United Nations Office for Drugs and Crime (UNODC). (2016). *World wildlife crime report: Trafficking in protected species*. Retrieved from https://www.unodc.org/documents/data-and-analysis/wildlife/World_Wildlife_Crime_Report_2016_final.pdf

- van Uhm, D. P. (2016). *The illegal wildlife trade: Inside the world of poachers, smugglers and traders*. Switzerland: Springer International Publishing.
- Wintle, B. C., Kennicutt, II, M. C., & Sutherland, W. J. (2020). Scanning horizons in research, policy and practice. In W. J. Sutherland, P. Brotherton, Z. Davies, N. Pettorelli, B. Vira, & J. Vickery (Eds.), *Conservation research, policy and practice* (pp. 29–47). Cambridge, UK: Cambridge University Press.
- Wintle, B. C., Boehm, C. R., Rhodes, C., Molloy, J. C., Millett, P., Adam, L., & Sutherland, W. J. (2017). A transatlantic perspective on 20 emerging issues in biological engineering. *eLife*, Feature article. 6, e30247.
- Xiao, Y., Guan, J., & Xu, L. (2017). *Wildlife cybercrime in China: E-commerce and social media monitoring in 2016*. TRAFFIC Briefing Paper. Retrieved from www.trafficj.org/publication/17_Briefing_Wildlife_Cybercrime_in_China.pdf
- Zheng, C. J. 《中国的中医药》白皮书 (全文). (2016). The State Council Information Office of the People's Repub-

lic of China. Retrieved from <https://www.scio.gov.cn/37236/38180/Document/1626694/1626694.htm>

SUPPORTING INFORMATION

Additional supporting information may be found online in the Supporting Information section at the end of the article.

How to cite this article: Esmail N, Wintle BC, t Sas-Rolfes M, et al. Emerging illegal wildlife trade issues: A global horizon scan. *Conservation Letters*. 2020;13:e12715. <https://doi.org/10.1111/conl.12715>